IN THE CLAIMS

Please amend the claims as follows:

1 (Previously Presented): A method of adjusting an image forming state of a pattern image projected onto an object via a projection optical system, said method comprising:

measuring information related to wavefront aberration of said projection optical system at one measurement point at the least in a field of said projection optical system; and

optimizing a weighting function to compensate an error of said pattern image, and calculating adjustment information in an adjusting unit that adjusts the image forming state of said pattern image, based on said information related to wavefront aberration and a Zernike sensitivity table corresponding to projection conditions of said pattern image.

2 (Previously Presented): The method according to Claim 1 wherein

in calculating said adjustment information, data related to a relation between an adjustment amount of said adjusting unit and a change in coefficients of each term in a Zernike polynomial is used.

3 (Previously Presented): The method according to Claim 2 wherein

in order to adjust the image forming state of said pattern image, adjustment information related to at least an optical element of said projection optical system is calculated.

4 (Previously Presented): The method according to Claim 3 wherein

in order to adjust the image forming state of said pattern image, adjustment information related to illumination light used for projection of said pattern image is calculated.

5 (Currently Amended): The method according to Claim 3 wherein

said projection conditions include at least an illumination condition of a pattern arranged on an object plane of said projection optical system.

6 (Previously Presented): The method according to Claim 5 wherein

when different pattern images are each projected by said projection optical system, said adjustment information is calculated using a Zernike sensitivity table for each of said pattern images.

7 (Previously Presented): The method according to Claim 6 wherein

said Zernike sensitivity table is a table in which a predetermined value of aberration is given to each term in a Zernike polynomial and a targeted image forming characteristic of said projection optical system is calculated for a plurality of terms in said Zernike polynomial.

8 (Previously Presented): The method according to Claim 1 wherein

in order to adjust the image forming state of said pattern image, adjustment information related to at least one of an optical element of said projection optical system and illumination light used for projection of said pattern image is calculated.

9 (Previously Presented): The method according to Claim 8 wherein

the optical element of said projection optical system is moved, based on said calculated adjustment information.

10 (Previously Presented): The method according to Claim 9 wherein

a characteristic of said illumination light is changed, based on said calculated adjustment information.

11 (Previously Presented): The method according to Claim 10 wherein

the characteristic of said illumination light includes wavelength.

12 (Previously Presented): The method according to Claim 1 wherein

said projection conditions include at least an illumination condition of a pattern arranged on an object plane of said projection optical system .

13 (Previously Presented): The method according to Claim 12 wherein

when different pattern images are each projected by said projection optical system, said adjustment information is calculated using a Zernike sensitivity table for each of said pattern images .

14 (Currently Amended): The method according to Claim 1 wherein

for the calculation of said adjustment information, ~~the~~ a least-squares method is used, and

said Zernike sensitivity table is a table in which a predetermined value of aberration is given to each term in a Zernike polynomial and a targeted image forming characteristic of said projection optical system is calculated for a plurality of terms in said Zernike polynomial.

15 (Previously Presented): The method according to Claim 14 wherein

information related to wavefront aberration of said projection optical system is measured at each of a plurality of points within a predetermined area, in which said pattern image is projected, in a field of said projection optical system, and

for the calculation of said adjustment information, the measurement information is used.

16 (Previously Presented): An exposure method in which a pattern is transferred onto an object via a projection optical system, said method including

calculating adjustment information in an adjusting unit that adjusts an image forming state of a pattern image projected onto said object via said projection optical system, using said method according to Claim 1; and

transferring said pattern onto said object by controlling said adjusting unit based on said calculated adjustment information.

17 (Previously Presented): The exposure method according to Claim 16 wherein

said adjustment information is calculated, based on said information related to wavefront aberration, said Zernike sensitivity table, and data related to a relation between an adjustment amount of said adjusting unit and a change in coefficients of each term in a Zernike polynomial.

18 (Previously Presented): The method according to Claim 1 wherein

in order to adjust the image forming state of said pattern image, at least one optical element of said projection optical system is moved, and

an adjustment amount of said at least one optical element is calculated as said adjustment information, based on said information related to wavefront aberration, said Zernike sensitivity table, and data related to a relation between an adjustment amount of said at least one optical element and a change in coefficients of each term in a Zernike polynomial.

19 (Previously Presented): An exposure method in which a pattern is transferred onto an object via a projection optical system, said method including

calculating adjustment information in an adjusting unit that adjusts an image forming state of a pattern image projected onto said object via said projection optical system, using the method according to Claim 18; and

transferring said pattern onto said object by controlling said adjusting unit based on said calculated adjustment information.

20-63 (Canceled)

64 (Currently Amended):An image forming characteristics adjusting method in which at least one image forming characteristic of a projection optical system is adjusted, said method including:

~~a measuring process in which~~ measuring information related to wavefront aberration of said projection optical system ~~is measured~~; and

adjusting said image forming characteristic ~~is adjusted~~ by driving an optical element of said projection optical system, based on data of a relation between an adjustment amount of said optical element and a change in coefficients of each term in a Zernike polynomial, and said information related to wavefront aberration.

65 (Original): The image forming characteristics adjusting method according to Claim 64 wherein

said information related to wavefront aberration is expressed in a Zernike polynomial, and different weighting is performed on a plurality of terms in said Zernike

polynomial to decide said adjustment amount of said optical element, in order to adjust an image forming characteristic of a plurality of types of said projection optical system.

66 (Currently Amended): An exposure method in which a pattern formed on a mask is transferred onto an object via a projection optical system, said exposure method comprising:

~~an adjusting process in which~~ adjusting at least one image forming characteristic of said projection optical system ~~is adjusted~~ using said image forming characteristics adjusting method according to Claim 64; and

~~a transferring process in which~~ transferring said pattern ~~is transferred~~ onto said object using said projection optical system whose image forming characteristic is adjusted.

67-72 (Canceled)

73 (Previously Presented): An exposure apparatus that transfers a pattern onto an object via a projection optical system, said exposure apparatus comprising:

an adjusting unit that adjusts an image forming state of a pattern image projected onto said object via said projection optical system; and

a computing unit that optimizes a weighting function to compensate an error of said pattern image, and calculates adjustment information in said adjusting unit, based on information related to wavefront aberration of said projection optical system and a Zernike sensitivity table corresponding to projection conditions of said pattern image.

74 (Previously Presented):The exposure apparatus according to Claim 73 wherein

for the calculation of said adjustment information, data related to a relation between an adjustment amount of said adjusting unit and a change in coefficients of each term in a Zernike polynomial is used.

75 (Previously Presented):The exposure apparatus according to Claim 74 wherein

said adjustment information includes an adjustment amount related to at least one of movement of an optical element of said projection optical system and a characteristic of illumination light used for projection of said pattern image.

76 (Previously Presented): The exposure apparatus according to Claim 75 wherein said projection conditions include at least an illumination condition of a pattern arranged on an object plane of said projection optical system .

77 (Previously Presented): The exposure apparatus according to Claim 76 wherein when different patterns are each transferred via said projection optical system, said adjustment information is calculated using a Zernike sensitivity table for each of said patterns.

78 (Previously Presented): The exposure apparatus according to Claim 73 wherein said adjustment information includes an adjustment amount related to at least one of movement of an optical element of said projection optical system and a characteristic of illumination light used for projection of said pattern image.

79 (Previously Presented): The exposure apparatus according to Claim 78 wherein said projection conditions include at least an illumination condition of a pattern arranged on an object plane of said projection optical system.

80 (Previously Presented): The exposure apparatus according to Claim 73 wherein for the calculation of said adjustment information, data of a relation between an adjustment amount of an optical element and a change in coefficients of each term in a Zernike polynomial is used, and

in order to adjust the image forming state of said pattern image, said optical element is moved based on said calculated adjustment information .

81 (Previously Presented): A device manufacturing method including a lithographic process, wherein

in said lithographic process, said adjusting unit is controlled based on said calculated adjustment information, and a pattern is transferred onto a substrate via said projection optical system, using the exposure apparatus according to Claim 73.

82 (Original):An exposure apparatus that transfers a pattern onto an object via a projection optical system, said exposure apparatus comprising:

a storage unit that stores data related to a relation between an adjustment amount of an optical element of said projection optical system and a change in coefficients of each term in a Zernike polynomial; and

an adjusting unit that adjusts at least one image forming characteristic of said projection optical system based on information related to wavefront aberration of said projection optical system and said data.

83 (Original):The exposure apparatus according to Claim 82 wherein said information related to wavefront aberration is expressed in a Zernike polynomial, and said adjusting unit decides said adjustment amount of said optical element by performing different weighting on a plurality of terms in said Zernike polynomial to adjust said image forming characteristic of a plurality of types of said projection optical system.

84 (Previously Presented): A device manufacturing method including a lithographic process, wherein

in said lithographic process, in order to transfer a pattern of a mask onto a substrate using an exposure apparatus having a projection optical system, an image forming characteristic of said projection optical system is adjusted, based on data of a relation between an adjustment amount of an optical element of said projection optical system and a change in coefficients of each term in a Zernike polynomial, and information related to wavefront aberration of said projection optical system.

85 (Previously Presented): An exposure apparatus that transfers a pattern onto an object via a projection optical system, said exposure apparatus comprising:

a computing unit that obtains a targeted image forming characteristic when a plurality of exposure conditions are settable on projecting said pattern by said projection optical system, based on information related to wavefront aberration of said projection optical system and a Zernike sensitivity table related to said targeted image forming characteristic of said projection optical system,as a linear sum of coefficients of each term in a Zernike polynomial that is decided based on said information related to wavefront aberration and said Zernike sensitivity table; and

an exposure control unit that sets an optimum exposure condition for said pattern, based on said targeted image forming characteristic that has been calculated for each of said exposure conditions.

86 (Original):The exposure apparatus according to Claim 85 wherein

said exposure conditions include numerical aperture of said projection optical system and an illumination condition of said pattern.

87 (Previously Presented): The exposure apparatus according to Claim 85 wherein

said computing unit obtains said targeted image forming characteristic using the Zernike sensitivity table for each of said exposure conditions, and when said targeted image forming characteristic includes image forming characteristics of a plurality of types, the Zernike sensitivity table is also used.

88 (Previously Presented): The exposure apparatus according to Claim 87 wherein

said computing unit calculates said targeted image forming characteristic when different patterns are projected by said projection optical system, using the Zernike sensitivity table for each of said patterns, and

said exposure control unit sets an optimum exposure condition for each of said different patterns, based on said targeted image forming characteristic that has been calculated for each of said patterns.

89 (Previously Presented): The exposure apparatus according to Claim 85 wherein

said computing unit obtains said targeted image forming characteristic using the Zernike sensitivity table for each of said exposure conditions, and also when different patterns are each projected by said projection optical system, calculates said targeted image forming characteristic using the Zernike sensitivity table for each of said patterns, and

said exposure control unit sets an optimum exposure condition by said different patterns, based on said targeted image forming characteristic that has been calculated for each of said patterns.

90-93 (Canceled)

94 (Previously Presented): The image forming characteristics adjusting method according to Claim 64 wherein

in order to adjust said image forming characteristic, an adjustment amount of said optical element is decided using a Zernike sensitivity table of an image forming characteristic of said projection optical system that becomes an evaluation item.

95 (Currently Amended): The image forming characteristics adjusting method according to Claim 94 wherein

in order to adjust said image forming characteristic, an adjustment amount of said optical element is decided using ~~the~~ a least-squares method.

96 (Previously Presented): The image forming characteristics adjusting method according to Claim 95 wherein

when different patterns are each projected by said projection optical system, an adjustment amount of said optical element is decided using the Zernike sensitivity table for each of said patterns.

97 (Previously Presented): The image forming characteristics adjusting method according to Claim 95 wherein

when said image forming characteristic that becomes an evaluation item includes image forming characteristics of a plurality of types, an adjustment amount of said optical element is decided using the Zernike sensitivity table for each of said image forming characteristics of a plurality of types.

98 (Previously Presented): The image forming characteristics adjusting method according to Claim 95 wherein

when a plurality of projection conditions are settable on projection of a pattern by said projection optical system, an adjustment amount of said optical element is decided using the Zernike sensitivity table for each of said projection conditions.

99 (Previously Presented): The image forming characteristics adjusting method according to Claim 95 wherein

when a plurality of illumination conditions are settable on projection of a pattern by said projection optical system, an adjustment amount of said optical element is decided using the Zernike sensitivity table for each of said illumination conditions.

100 (Previously Presented): The image forming characteristics adjusting method according to Claim 64 wherein

information related to wavefront of said projection optical system is measured at each of a plurality of points within a predetermined area, in which a pattern is projected, in a field of said projection optical system, and the measurement information is used for adjustment of said image forming characteristic.

101 (Previously Presented): The image forming characteristics adjusting method according to Claim 64 wherein

in order to adjust said image forming characteristic, an adjustment amount of said optical element is decided using a weighting function.

102 (Currently Amended): The image forming characteristics adjusting method according to Claim 101 wherein

for decision of said adjustment amount, ~~the~~ a least-squares method is used.

103 (Previously Presented): The image forming characteristics adjusting method according to Claim 102 wherein

for decision of said adjustment amount, a Zernike sensitivity table is used, said Zernike sensitivity table being obtained by giving a predetermined value of aberration to each term in a Zernike polynomial and calculating an image forming characteristic that becomes an evaluation item of said projection optical system in each of a plurality of terms in said Zernike polynomial.

104 (Previously Presented): The image forming characteristics adjusting method according to Claim 102 wherein

information related to wavefront of said projection optical system is measured at each of a plurality of points within a predetermined area, in which a pattern is projected, in a

field of said projection optical system, and the measurement information is used for decision of said image forming characteristic.

105 (Currently Amended): An exposure method in which a pattern is transferred onto an object via a projection optical system, said method comprising:

calculating a targeted image forming characteristic of said projection optical system for each of a plurality of exposure conditions settable when said pattern is projected by said projection optical system, based on information related to wavefront aberration of said projection optical system and a Zernike sensitivity table ~~relatd~~ related to a targeted image forming characteristic of said projection optical system, as a linear sum of coefficients of each term in a Zernike polynomial that is decided based on said information related to wavefront aberration and said Zernike sensitivity table; and

setting an optimum exposure condition with respect to said pattern, based on said targeted image forming characteristic calculated for each of said exposure conditions, and transferring said pattern onto said object.

106-109 (Canceled)

110 (Previously Presented): An exposure method in which a pattern is transferred onto an object via a projection optical system, said method comprising:

deciding coefficients of each term in a Zernike polynomial based on information related to wavefront aberration of said projection optical system; and

calculating an image forming characteristic that becomes an evaluation item of said projection optical system, based on said decided coefficients of each term in a Zernike polynomial, and a Zernike sensitivity table that corresponds to a pattern to be transferred onto said object and an illumination condition of the pattern, as a linear sum of said decided coefficients of each term in a Zernike polynomial and said Zernike sensitivity table.

111 (Canceled)

112 (Previously Presented): The exposure method according to Claim 110 wherein said Zernike sensitivity table is obtained by giving a predetermined value of aberration to each term in said Zernike polynomial and calculating an image forming

characteristic of said projection optical system in each of a plurality of terms in said Zernike polynomial.

113 (Previously Presented): The exposure method according to Claim 112 wherein said image forming characteristic that becomes an evaluation item is calculated at each of a plurality of points within a predetermined area, in which a pattern is projected, in a field of said projection optical system.

114 (Previously Presented): An exposure method in which a pattern is transferred onto an object via a projection optical system, said method comprising:

optimizing a weighting function to compensate an error of a pattern image projected onto said object, and calculating adjustment information of said projection optical system, based on information related to wavefront aberration of said projection optical system and a Zernike sensitivity table that corresponds to a pattern to be transferred onto said object and an illumination condition of the pattern; and

adjusting said projection optical system based on said calculated adjustment information.

115 (Canceled)

116 (Currently Amended): The exposure method according to Claim 114 wherein for the calculation of said adjustment information, ~~the~~ a least-squares method is used.

117 (Previously Presented): The exposure method according to Claim 116 wherein an adjustment amount of an optical element of said projection optical system is calculated as said adjustment information, based on data of a relation between the adjustment amount of the optical element of said projection optical system and a change in coefficients of each term in a Zernike polynomial.

118 (Previously Presented): The exposure method according to Claim 117 wherein coefficients of each term in a Zernike polynomial are decided by measuring wavefront aberration of said projection optical system, and

for the calculation of said adjustment amount, said decided coefficients of each term in said Zernike polynomial are used.

119 (Previously Presented): The exposure method according to Claim 118 wherein said weighting function is a function to perform weighting on said decided coefficients of each term in said Zernike polynomial.

120 (Previously Presented): The exposure method according to Claim 119 wherein said adjustment amount is calculated by optimizing said weighting function so that said error does not exceed a permissible value at each of a plurality of points within a predetermined area, in which a pattern is projected, in a field of said projection optical system.

121 (Previously Presented): The exposure method according to Claim 120 wherein said Zernike sensitivity table is obtained by giving a predetermined value of aberration to each term in a Zernike polynomial and calculating an image forming characteristic of said projection optical system in each of a plurality of terms in said Zernike polynomial.

122 (Previously Presented): An exposure apparatus that transfers a pattern onto an object via a projection optical system, said exposure apparatus comprising:

a measuring unit that measures information related to wavefront aberration of said projection optical system, and

a computing unit that decides coefficients of each term in a Zernike polynomial based on said information related to wavefront aberration, and calculates an image forming characteristic that becomes an evaluation item of said projection optical system, based on said decided coefficients of each term in a Zernike polynomial and a Zernike sensitivity table that corresponds to a pattern to be transferred onto said object and an illumination condition of the pattern, as a linear sum of said decided coefficients of each term in a Zernike polynomial and said Zernike sensitivity table.

123 (Canceled)

124 (Previously Presented): The exposure apparatus according to Claim 122 said Zernike sensitivity table is obtained by giving a predetermined value of aberration to each term in said Zernike polynomial and calculating an image forming characteristic of said projection optical system in each of a plurality of terms in said Zernike polynomial.

125 (Previously Presented): The exposure apparatus according to Claim 124 wherein said image forming characteristic that becomes an evaluation item is calculated at each of a plurality of points within a predetermined area, in which a pattern is projected, in a field of said projection optical system.

126 (Previously Presented): An exposure apparatus that transfers a pattern onto an object via a projection optical system, said apparatus comprising:

a computing unit that optimizes a weighting function to compensate an error of a pattern image projected onto said object, and calculates adjustment information of said projection optical system, based on information related to wavefront aberration of said projection optical system and a Zernike sensitivity table that corresponds to a pattern to be transferred onto said object and an illumination condition of the pattern; and

an adjusting unit that adjusts said projection optical system based on said calculated adjustment information.

127 (Canceled)

128 (Previously Presented): The exposure apparatus according to Claim 126 wherein for the calculation of said adjustment information, the least-squares method is used.

129 (Previously Presented): The exposure apparatus according to Claim 128 wherein an adjustment amount of an optical element of said projection optical system is calculated as said adjustment information, based on data of a relation between the adjustment amount of the optical element of said projection optical system and a change in coefficients of each term in a Zernike polynomial.

130 (Previously Presented): The exposure apparatus according to Claim 129 wherein

coefficients of each term in a Zernike polynomial are decided by measuring wavefront aberration of said projection optical system, and

for the calculation of said adjustment amount, said decided coefficients of each term in said Zernike polynomial are used.

131 (Previously Presented): The exposure apparatus according to Claim 130 wherein

said weighting function is a function to perform weighting on said decided coefficients of each term in said Zernike polynomial.

132 (Previously Presented): The exposure apparatus according to Claim 131 wherein

said adjustment amount is calculated by optimizing said weighting function so that said error does not exceed a permissible value at each of a plurality of points within a predetermined area, in which a pattern is projected, in a field of said projection optical system.

133 (Previously Presented): The exposure apparatus according to Claim 132 wherein

said Zernike sensitivity table is obtained by giving a predetermined value of aberration to each term in a Zernike polynomial and calculating an image forming characteristic of said projection optical system in each of a plurality of terms in said Zernike polynomial.

134 (Previously Presented): The exposure apparatus according to Claim 133, further comprising:

a setting unit that is capable of changing an illumination condition of said pattern, wherein

when said illumination condition is changed by said setting unit, said computing unit uses a Zernike sensitivity table corresponding to said changed illumination condition.

135 (Previously Presented): The exposure apparatus according to Claim 126, further comprising:

a measuring unit that measures wavefront aberration of said projection optical system, said measuring unit being at least partly attachable to an exposure apparatus main body including said projection optical system.

136-138 (Canceled)

139 (Previously Presented): A device manufacturing method, wherein

a device pattern is transferred onto a photosensitive object using said exposure method according to Claim 16.

140 (Previously Presented): A device manufacturing method, wherein

a device pattern is transferred onto a photosensitive object using said exposure method according to Claim 110.

141 (Previously Presented): A device manufacturing method, wherein

a device pattern is transferred onto a photosensitive object using said exposure method according to Claim 114.

142 (Currently Amended): A computer readable medium encoded with a program that makes a control computer of an exposure apparatus that transfers a pattern onto an object via a projection optical system execute a predetermined process, said program making said control computer execute:

a deciding procedure in which coefficients of each terms of a Zernike polynomial are decided based on information related to wavefront aberration of said projection optical system; and

a calculating procedure in which an image forming characteristic that becomes an evaluation item of said projection optical system is calculated, based on said decided coefficients of each term of a Zernike polynomial and a Zernike sensitivity table that corresponds to a pattern to be transferred onto said object and an illumination condition of the pattern, as a linear sum of said decided coefficients of each term in a Zernike polynomial and said Zernike sensitivity table.

143 (Currently Amended): A computer readable medium encoded with a program that makes a control computer of an exposure apparatus that transfers a pattern onto an object via a projection optical system execute a predetermined process, said program making said control computer execute:

a calculating procedure in which a weighting function to compensate an error of a pattern image projected onto said object is optimized, and adjustment information of said projection optical system is calculated, based on information related to wavefront aberration of said projection optical system, and a Zernike sensitivity table that corresponds to a pattern to be transferred onto said object and an illumination condition of the pattern; and

an adjusting procedure in which said projection optical system is adjusted based on said calculated adjustment information.

144 (Currently Amended): A computer readable medium encoded with a program that makes a control computer of an exposure apparatus that transfers a pattern onto an object via a projection optical system execute a predetermined process, said program making said control computer execute:

a measuring procedure in which information related to wavefront aberration of said projection optical system is measured; and

an adjusting procedure in which an image forming characteristic of said projection optical system is adjusted by driving an optical element of said projection optical system, based on data of a relation between an adjustment amount of said optical element and a change in coefficients of each term in a Zernike polynomial, and said information related to wavefront aberration.

145 (Currently Amended): A computer readable medium encoded with a program that makes a control computer of an exposure apparatus that transfers a pattern onto an object via a projection optical system execute a predetermined process, said program making said control computer execute:

a calculation procedure in which an image forming characteristic for each of a plurality of exposure conditions is calculated, based on coefficients of each term in a Zernike polynomial that is decided based on information related to wavefront aberration of said projection optical system, and a Zernike sensitivity table corresponding to each of said plurality of exposure conditions that are settable when projecting said pattern by said projection optical system, as a linear sum of said decided coefficients of each term in a Zernike polynomial and said Zernike sensitivity table; and

a transferring procedure in which an optimum exposure condition for said pattern is set based on said image forming characteristic calculated for each of said exposure conditions, and said pattern is transferred onto said object.